Pedagogy

1. Ensures utilization of researched-based strategies

	This column is the goal for STEM classrooms	This column is how STEM PD will help teachers develop skills for STEM classrooms			Reviewers use this space to cite examples of evidence that the criterion is met or not met
Criteria	**Outcomes**	**5**	**3**	**1**	**Evidence**
1.A	***Educators implement research-based practices that generate exemplary STEM teaching and learning experiences.***	Professional development is designed based on research-based approaches that are identified and defined in terms of student outcomes and activities with evidence cited for efficacy.	Professional development is designed based on research-based approaches that are identified and defined in terms of student outcomes and activities. There is no evidence cited for efficacy.	Professional development is designed based on research-based strategies that are listed, but the implementation is not specifically defined in terms of student outcomes or activities.	(1)
1.B	***Examples of research-based practices that generate exemplary STEM teaching and learning experiences that educators may implement***	Examples of research-based approaches are: • Cognitively Guided Instruction (CGI) • Learning Cycle • Project / Problem Based Learning • Argument-Based Inquiry • Understanding by Design (UbD)			(2)

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		• Others that meet research-based criteria			

2. Ensures development of argument-based classrooms (ABC)

2.A	*Educators engage students in learning experiences that include designing tests and making claims and supporting claims with evidence.*	Professional development includes theory and immersion experiences that model the development of negotiation in argument – based classrooms. Educators are expected to model appropriate listening and speaking to defend a claim just as students would in their classrooms.	Professional development includes theory about implementing negotiation in argument –based classrooms but does not model how implementation occurs. Participants are expected to describe how to make a claim and support the claim with evidence	Professional development includes reference to argument-based classrooms but does not include the theory or model implementation of negotiation in argument –based classrooms. Participants can recognize making a claim and supporting the claim with evidence.	(3)
2.B	*Educators engage students in learning activities that encourage student construction of claims that are backed with evidence and include negotiation about claims and evidence.*	Professional development includes modeling and designing learning experiences where students make claims, support claims with evidence and negotiate about conceptions.	Professional development includes the modeling of making claims and supporting claims with evidence but does not include designing learning experiences.	Professional development includes telling teachers how to make a claim and support the claim with evidence.	(4)

3. Ensures a learner-centered environment

3.A	*Educators provide*	Professional development	Professional development	Professional development is	(5)

	learning experiences where they act as facilitators as opposed to the directors of student-learning experiences.	provides experiences that model the facilitation of a learner-centered environment rather than a teacher-directed environment. Professional development provides opportunities to experience and develop experiences that encourage students to work in collaborative groups without direct instruction.	provides theory but does not include demonstrations of or models of the facilitation of a learner-centered environment. Professional development provides theory but does not provide opportunities to experience and develop experiences that encourage students to work in collaborative groups without direct instruction.	teacher directed and does not promote a learner-centered environment. Professional development is does not promote a collaborative classroom environment.	
3.B	*Educators provide learning experiences where students are active, responsible participants in their own learning.*	Professional development includes modeling how to create a learning environment where the students are responsible for their learning. Strategies to increase student engagement are utilized. Professional development includes theory and practice regarding how to encourage students to apply concepts	Professional development includes theory about how to create a learning environment where students are responsible for their learning. Strategies to increase student engagement are identified. Professional development provides theory but does not effectively model the application of concepts.	Professional development does not adequately provide theory or model how create a learning environment where students are responsible for their learning. Direct instruction is utilized. Professional development does not adequately provide theory or model application of new concepts.	(6)

		in new situations.			
		Professional development models how to design learning experiences so that student questions lead to investigations.	Professional development provides theory but does not effectively model how to design learning experiences so that student questions lead to investigations.	Professional development does not adequately provide theory or model how to design learning experiences so that student questions lead to investigations.	
3.C	*Educators provide learning experiences where students are participants in the evaluation of their learning.*	Professional development includes theory and modeling the elicitation of prior knowledge.	Professional development includes theory but does not include modeling the elicitation of prior knowledge.	Professional development does not include theory or modeling the elicitation of prior knowledge.	(7)
		Professional development models strategies for the ongoing assessment of student learning.	Professional development models the incorporation of assessment of student learning.	Professional development does not model the ongoing assessment of student learning.	

4. Ensures that evidence of learning competencies and development of authentic assessments is included

4. *A* .	*Educators design and implement assessments that are authentic and provide students with multiple opportunities to demonstrate competency of their knowledge, skills, and understandings*	Professional development provides training to develop and implement authentic summative and formative assessments that measure the Iowa Core and/or content standards and emphasize:	Professional development provides training on developing and implementing authentic assessments that align with the knowledge, skills, and understandings tied to the Iowa Core and/or content	Professional development does not include the development or implementation of authentic assessments.	(8)

	identified in the Iowa Core and/or content standards and processes found in 21st Century Skills.	*Critical Thinking* *Complex Communication* *Creativity* *Collaboration* *Flexibility and Adaptability* *Productivity and Accountability*	standards but are not linked to 21st Century Skills.		
4.B (9)	*Educators design and implement assessments and instruction that are aligned to the IA Core and/or content standards at the appropriate level of thinking.*	Professional development provides opportunities to design assessments and instruction that align with the cognitive complexity called for in the knowledge, skills and understandings identified in the Iowa Core and/or content standards.	Professional development includes some opportunities to design assessments that include instructional alignment with the cognitive complexity called for in the knowledge, skills and understandings identified in the Iowa Core and/or content standards.	Professional development does not include opportunities to align assessments, instruction, and cognitive complexity called for in the knowledge, skills and understandings identified in the Iowa Core and/or content standards.	(9)

5. Ensures differentiation to provide for multiple access points for all learners.

5.A	*Educators are provided with professional development opportunities that are differentiated based on the needs of the educator.*	Professional development provides the appropriate level and type of scaffolding that meets the needs of each educator.	Professional development provides the appropriate level and type of scaffolding and support that meets the needs of most of the educators.	Professional development is designed to be the same for all educators.	(10)
5.B	*Educators have freedom to pursue various opportunities to engage in professional growth.*	Professional development options are provided for educators to participate in appropriate learning	Professional development options are limited.	Professional development options are not available.	(11)

		opportunities based on individual needs.			

Disciplined Inquiry

1. Ensures that the learning environment includes development of conceptual understanding of content and disciplinary processes.

Criteria	Outcomes	5	3	1	Evidence
1.A	*Educators receive content-specific professional development.*	Professional development includes content specific professional development designed to increase conceptual understanding.	Professional development includes content specific professional development but focuses only on topics and facts.	Professional development does not include content specific professional development designed to increase conceptual understandings.	(12)
1.B	*Educators design and implement assessments and instruction aligned to the critical concepts in STEM disciplines as appropriate*	Professional development includes designing & implementing assessments and instruction aligned to the critical concepts in the STEM disciplines as appropriate.	Professional development does not address assessments and instruction aligned to the critical concepts in the STEM disciplines.	Assessments and instruction are only connected to topics and facts in the STEM disciplines.	(13)
1.C	*Educators design and implement instruction that focuses on the practices within the STEM disciplines.*	Professional development includes designing instruction that incorporates the practices connected to the STEM disciplines.	Professional development includes instructional strategies but not aligned with the practices.	Professional development doesn't include connections to the practices within the STEM disciplines.	(14)

2. Couples rigorous academic concepts in a real world context

2.A (15)	**Educators implement curriculum that is authentically integrated and mirrors real world context.**	Professional development incorporates the implementation of appropriate interdisciplinary curriculum where knowledge is interconnected and interdependent in an authentic context.	Professional development incorporates the implementation of interdisciplinary curriculum where processes, methods and language from more than one discipline are integrated to examine a topic or solve a problem in an authentic context.	Professional development incorporates implementation of multidisciplinary curriculum where disciplines are taught separately, but a common theme, skills or practice is infused into each.	(15)
2.B	**Educators provide learning experiences opportunities where students design solutions that require skills and knowledge from multiple disciplines.**	Professional development provides opportunities to develop skills to design learning experiences where students design solutions that require skills and knowledge from the integration of multiple disciplines.	Professional development provides some opportunities to develop skills to design learning opportunities where student design solutions that require skills and knowledge from several disciplines.	Professional development provides few opportunities to develop skills to design learning opportunities where student design solutions that require skills and knowledge from one or two.	(16)

Learning Community

1. Ensures stakeholders interested in STEM teaching and learning are engaged

Criteria	Outcomes	5	3	1	Evidence
1.A	**Educators build strategic alliances with formal PK-16, CC, HE, business,**	Professional development incorporates the development of partnerships	Professional development encourages the development of establishing	Professional development identifies the importance of building strategic alliances with	(17)

	nonformal, DE, AEA, LEA, students, parents, and the community.	that enable students to apply knowledge and skills to real-world settings.	partnerships that enable students to apply knowledge and skills to real-world settings	business, community organizations and institutions of higher education	
		Participants include stakeholders from multiple groups	Participants include stakeholders from several groups	Participants include stakeholders from a few groups	

2. Ensures opportunities for teacher leadership and collaboration that promotes systemic change.

2.A	*Educators utilize a professional development plan that includes research- based opportunities for teacher leadership, or evidence of prior effectiveness for systemic change; the PD plan also includes iterative assessment loops.*	Professional development model is aligned with and supported by research focused on teacher leadership and ownership and professional development model has evidence of prior success regarding teacher leadership and ownership. Professional development model has tools and strategies to collect and effectively utilize teacher feedback in order to impact ongoing PD.	Professional development model is aligned to and supported by research focused on teacher leadership and ownership or/and professional development model references evidence of prior success regarding teacher leadership and ownership Professional development model has tools and strategies to collect and review teacher feedback in order to impact ongoing PD.	Professional development model references research focused on teacher leadership or/and professional development model references evidence of prior success regarding teacher leadership Professional development model has tools and strategies to collect teacher feedback.	(18)
2.B	*Educators utilize productive focused collaboration through a*	Professional development includes effective group processes that are	Professional development includes Effective group processes that are	Professional development group processes are referenced.	(19)

	variety of formats and in various time frames. Collaboration characterized by use of group processes, regular scheduled time, supported by effective use of technology will offer strong opportunity for learning.	consistently employed. Multiple periods of appropriate time are specified throughout the proposed PD timeline, preferably during school day, for collaboration. Professional development will effectively utilize technology throughout proposed PD timeline as appropriate to enhance collaborative learning of participants.	employed. Periods of time are specified throughout the proposed PD timeline for collaboration. Professional development will utilize technology as appropriate to enhance collaborative learning of participants.	Time is suggested within schedule for collaboration. Professional development will utilize technology as appropriate to promote collaboration.	
2C.)	*Educators are committed to implementing STEM professional development that has capacity in vision, knowledgeable personnel, resources, assessment, and leadership expertise to successfully implement a systemic approach to STEM focused learning.*	Professional development is committed to long term sustained planning, expanded scope of implementation, and ongoing assessment. Professional development incorporates and aligns workforce and global projections, with data collected, to guide and monitor planning decisions	Professional development is committed to long term planning, expanded implementation, and assessment. Professional development incorporates workforce and global projections, with data collected, to guide and monitor planning decisions.	Professional development is committed to planning, implementation, and assessment. Professional development is mindful of workforce and global projections, use data collected to guide and monitor planning.	(20)

		throughout PD timeline.			
		Professional development includes targeted and ongoing dissemination of information, research, and trends that may impact expectations for student learning.	Professional development includes targeted dissemination of information, research, and trends that may impact expectations for student learning.	Professional development includes dissemination of information, research, or trends which may impact expectations for student learning.	

3. Ensures sustained support for implementation

3.A	*Educators incorporate professional development that includes a program evaluation and system supports to ensure fidelity of implementation and the monitoring of implementation.*	Professional development includes a program evaluation detailing the knowledge, aspirations, skills, attitudes and behaviors of all stakeholders and system supports (structure & resources) to ensure fidelity and the monitoring of the implementation.	Professional development includes a program evaluation but does not include the system supports to ensure fidelity of the implementation. .	Professional development doesn't include a program evaluation or the system supports.	(21)
3.B	*Educators have opportunities to collaboratively engage in collective inquiry about professional development.*	Professional development includes opportunities for educators to be engaged in relevant lesson/unit design work, decision-making and data analysis processes.	Professional development includes some opportunities for educators to be engaged in lesson/unit design work and data analysis processes.	Professional development includes limited opportunities for educators to be engaged in relevant lesson/unit design work and decision-making and data analysis processes.	(22)

4. Ensures that learners that are College and/or Career Ready

4.A	*Educators embed the utilization of 21st century practices* to promote content and mastery to facilitate real world investigations, applications and innovations.*	Professional development embeds learning opportunities that focus on: *Critical Thinking Complex Communication Creativity Collaboration Flexibility and Adaptability Productivity and Accountability* so that that students are able to apply important academic concepts in real world contexts.	Professional development identifies the need to include learning opportunities that focus on: *Critical Thinking Complex Communication Creativity Collaboration Flexibility and Adaptability Productivity and Accountability* so that that students are able to apply important academic concepts in real world contexts.	Professional development omits learning opportunities that focus on: *Critical Thinking Complex Communication Creativity Collaboration Flexibility and Adaptability Productivity and Accountability* so that that students are able to apply important academic concepts in real world contexts.	(23) *21 Century as defined by the Iowa Core
4. B	*Educators implement learning opportunities that prepare students to be college and career ready as identified and measured by the National Career Readiness Certificate (NCRC).*	Professional development includes modeling and educators designing learning experiences that develop skills identified as National Career Readiness Skills so that students are able to apply important academic concepts in real world contexts.	Professional development identifies learning opportunities that develop National Career Readiness Skills so that students are able to apply important academic concepts in real world contexts.	Professional development does not identify or incorporate learning opportunities that develop skills identified as National Career Readiness Skills so that students are able to apply important academic concepts in real world contexts.	(24)
4. C	*Educators utilize cutting edge technologies to ensure that students are*	Professional development provides learning on how to embed cutting edge	Professional development identifies cutting edge technologies that enable	Professional development does not include cutting edge technologies that enable students	(25)

	able to apply learning to real world contexts.	technologies that enable students to apply important academic concepts in real world contexts	students to apply important academic concepts in real world contexts	to apply important academic concepts in real world contexts	

Resources/Bibliography

General STEM Professional Development Resources

1. Characteristics of High Functioning STEM Schools: Innovation Configurations. S2TEM Centers SC, 2013. www.s2temsc.org
2. Teacher Professional Development for Common Core Standards Transition (Hanover Research in D.C.)
3. Professional Development in the United States: Trends and Challenges (National Staff Development Council)
4. Professional Learning in the Learning Profession: A Status Report on Teacher Development in the US & Abroad (NSDC)
5. National Research Council. *How Students Learn: Science in the Classroom*. Washington, DC: The National Academies Press, 2005.
6. National Research Council. *How Students Learn: Mathematics in the Classroom*. Washington, DC: The National Academies Press, 2005.
7. National Research Council. *Taking Science to School: Learning and Teaching Science in Grades K-8*. Washington, DC: The National Academies Press, 2007.

Pedagogy

General:

STEM Education Quality Framework Part 1 (rubric) - Dayton Regional STEM Center

STEM Education Quality Framework Part 2 (questionnaire) - Dayton Regional STEM Center

Science Classroom Observation Protocol (Washington State)

1. Ensures utilization of researched-based strategies
1A (1)
1B (2)

Bybee, R., Taylor, J. A., Gardner, A., Van Scotter, P., Carlson, J., Westbrook, A., Landes, N. (2006). *The BSCS 5E Instructional Model: Origins and Effectiveness.* Colorado Springs, CO: BSCS.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, Virginia: Author. [for PD, see The Teaching Principle, within Putting the Principles into Action]

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B. Wilson (Ed) Constructivist Learning Environments: Case Studies in Instructional Design, 1995, 135-150

Problem Based Learning: An instructional model and its constructivist framework, John R. Savery and Thomas M. Duffy; Indiana University (Bloomington)

https://www.teachingchannel.org/videos/using-socratic-seminars-in-classroom

https://www.teachingchannel.org/videos/ninth-grade-biology-lesson

https://www.teachingchannel.org/videos/learning-through-experiences

2. Ensures development of argument-based classrooms (ABC)
2A (3)
Math Core (Iowa) item #3
Literacy Core (Iowa) Appendix A page 23
NGSS - Appendix F page 13
Argument Based Inquiry
Framework for K-12 Science Standards

2B (4)
Argument –based inquiry

Fulton, Lori & Poeltler, Emily. "Developing a Scientific Argument"   http://learningcenter.nsta.org/files/SC1309_30.pdf

3. Ensures a learner-centered environment
3A (5)
Iowa Department of Education From IC Characteristics of Effective instruction: START

Argument-based inquiry

Possilble link: http://www.academia.edu/4096786/Scientific_argumentation_as_a_foundation_for_the_design_of_inquiry-based_science_instruction

Inquire Within   http://www.corwin.com/books/Book241066/features

3B (6)
Argument-based inquiry

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3C (7)

AIW Department of Education

Argument based inquiry

Costa, A. (2009). *Describing the habits of mind*. In Costa, A. & Kallick, B. (Ed.), Learning and leading with habits of mind. Alexandria, VA:ASCD.

    [Habits of Mind](#)

4. Ensures that evidence of learning competencies and development of authentic assessments is included

4A (8)
South Carolina /SC pg10.
Tony Wagner http://www.tonywagner.com/7-survival-skills

4B (9)
1. Competency

2. Authentic assessments

3. Formative assessment

[Uncovering Student Ideas, Page Keeley Uncovering Studen](#)

5. Ensures differentiation to provide for multiple access points for all learners.

5A (10)
5B (11)
5: Differentiated to provide for multiple access points for all learners
Personalized Learning   http://siia.net/pli/presentations/PerLearnPaper.pdf   I know this paper is talking about students, but if its good for the students then its needed for the teachers also!

Tang, M. & Byrne, R. (2007). Regular Versus Online Versus Blended: A Qualitative Description of the Advantages of the Electronic Modes and a Quantitative Evaluation. International Journal on E-Learning, 6(2), 257-266. Chesapeake, VA: AACE. Retrieved August 28, 2013 from http://www.editlib.org/p/21801.

Vaughan, N. (2007). Perspectives on Blended Learning in Higher Education. International Journal on E-Learning, 6(1), 81-94. Chesapeake, VA: AACE. Retrieved August 27, 2013 from http://www.editlib.org/p/6310.

Verkroost, M.J., Meijerink, L., Lintsen, H. & Veen, W. (2008). Finding a Balance in Dimensions of Blended Learning. International Journal on E-Learning, 7(3), 499-522. Chesapeake, VA: AACE. Retrieved August 27, 2013 from http://www.editlib.org/p/23568.

5A

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IPDM

Content

General:

STEM Education Quality Framework Part 1 (rubric) - Dayton Regional STEM Center

STEM Education Quality Framework Part 2 (questionnaire) - Dayton Regional STEM Center

Science Classroom Observation Protocol (Washington State)

1. Ensures that the learning environment includes development of conceptual understanding of content and disciplinary processes.
1A (12)
1B (13)
1C (14)

Conceptual Based Teaching, Lynn Erickson

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, Virginia: Author.

>   Questioning Our of Questioning Pattern

Ma, L.(1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the U.S.* New Jersey: Lawrence Erlbaum.

National Council of Teachers of Mathematics. (1991). Professional standards for teaching mathematics. Reston, VA:Author.

1C. The use of blooms taxonomy of Learning Domains
Tony Wagner 7 survival skills

2. Couples rigorous academic concepts in a real world context
2A (15)

2B (16)
South Carolina Rubric p. 8

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Iowa Core Math, Literacy, Science

Teacher Professional Development for Common Core Standards Transition

Framework for K-12 Science Education

NGSS Resource Quality Rubric (link to come)

Project Based Learning:

Critical Thinking Rubric for PBL

PBL Essential Elements Checklist

PBL in the Elementary Grades

Strategies for Embedding Project-Based Learning into STEM Education from Edutopia

Introduction to Project Based Learning

Argument Based Inquiry

Learning Cycle

Service Learning

STEM Education and Service-Learning - National Service-Learning Clearinghouse

Self-Assessment Rubric for the Institutionalization of Service-Learning in Higher Education

5E Model of Integrated STEM Education

STEM Integration: Teacher Perceptions and Practice (research article)

Indiana Dept of Ed STEM Integration Map Public Review form

Learning Community

1. Ensures stakeholders interested in STEM teaching and learning are engaged

1A (17)
Business / education partnerships

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Nonformal education

Extension and Outreach

2. Ensures opportunities for teacher leadership and collaboration that promotes systemic change

2A (18)
2B (19)
2C (20)

National Research Council. (2013). *Monitoring progress toward successful K-12 STEM education: A nation advancing?* Committee on the Evaluation Framework for Successful K-12 STEM Education. Board on Science Education and Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

2. Teacher leaders

Learning from Leadership: Investigating the Links to Improved Student Learning. Final Report of Research to the Wallace Foundation *University of Minnesota Karen Seashore, Louis Kyla, L. Wahlstrom, Michael Michlin, Molly Gordon, Emanda Thomas; University of Toronto Kenneth Leithwood, Stephen E. Anderson, Blair Mascall, Tiiu Strauss, Shawn Moore. July 2010. University of Minnesota (pages 66-76).*

 Leithwood, K., Harris, A., & Strauss, T. (2010). *Leading school turnaround: How successful leaders transform low-performing schools*. San Francisco, CA: Jossey-Bass

3. Collaboration / PLC / Dufour

3A South Carolina rubrics (pgs 7 and 9)
    IPDM (Iowa Professional Development Model)

Takahashi, A., & Yoshida, M. (2004). Ideas for establishing lesson study communities. Teaching Children Mathematics, 10(9), 436-443.

Learning from Leadership: Investigating the Links to Improved Student Learning. Final Report of Research to the Wallace Foundation *University of Minnesota Karen Seashore, Louis Kyla, L. Wahlstrom, Michael Michlin, Molly Gordon, Emanda Thomas; University of Toronto Kenneth Leithwood, Stephen E. Anderson, Blair Mascall, Tiiu Strauss, Shawn Moore. July 2010. University of Minnesota (pages 66-76).*

Stigler, J., & Hiebert, J. (1999). The teaching gap: Best ideas from the world's teachers for improving education in the classroom. New York: Free Press.
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Lewis, C. (2002). Lesson study: A handbook of teacher-led instructional improvement. Philadelphia: Research for Better Schools.

4. Systemic change / systems thinking

3. Ensures sustained support for implementation

3A (21)
3B (22)

1. Implementation book used at AEA 267 -
2. Authentic Intellectual Work (AIW)
3. Instructional Coaching (Jim Knight)
Bybee, R., (1997). The sputnik era: Why is this educational reform different from all other reforms? *National Academy of Sciences.* Retrieved from http://www.nas.edu/sputnik/bybee1.htm
National Council of Teachers of Mathematics. (1991). Professional standards for teaching mathematics. Reston, VA:Author. [see Standard 2 of the Standards for support and development of mathematics teachers and teaching section.]

4. Ensures that learners that are College and/or Career Ready

4A (23)
4B (24)
4C (25)

1. Skilled Iowa
2. Iowa Workforce Development
4A SC Rubric p. 8

Rubric Examples
Arizona STEM Immersion Matrix for Schools and Districts
Characteristics of High Functioning STEM Schools: Innovation Configurations
Change the Equation - Design_Principles_Rubric_v3
Dayton Ohio STEM Education Quality Framework (rubric)
Iowa Scale-Up Rubric (2012)

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NC Dept Public Instruction - ELEMENTARY SCHOOL STEM Attribute Implementation Rubric
NC Dept Public Instruction - MIDDLE SCHOOL STEM Attribute Implementation Rubric
NC Dept Public Instruction - HIGH SCHOOL STEM Attribute Implementation Rubric
NC Golden LEAF STEM Initiative- Implementation Rubric
NC STEM Attribute Implementation Rubric
Tennessee STEM Professional Development Grant Rubric

Model rubric for STEM Professional Development Rubric
T-STEM Blueprint

STEM Practices:
1. Science Practices (NGSS)

2. Engineering practices (NGSS)

3. 21st Century Skills (ISTE)

4. Math Practices
Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Literacy Practices

ISTE